

ARGONNE
NATIONAL
LABORATORY

701120

40-015
INTRA-LABORATORY MEMO

MICROFILMED

June 24, 1981

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TO: J. Rundo

FROM: R. P. Larsen 

CHR RECORDS

SUBJECT: Comparison of the plutonium distribution in the skeletal remains of 40-015 with that in 40-010

In the 1978-79 Annual Report a comparison was made of the distribution of plutonium in the skeletal remains of 40-010 with that in 40-015. To make this comparison nine bone samples from each skeleton were analyzed: 5 sections of individual bones, 3 whole bones, and one group of bones. The concentrations in the sample from each skeleton were then divided by the concentration in a particular sample from that skeleton, the femur midshaft. The agreement of the values for these concentration ratios suggested that the distribution of plutonium in 40-010 was not atypical. The possibility of this was based on the knowledge that a symptom of Cushing's syndrome, the illness to which 40-010 succumbed, is osteoporosis.

Since July 1979 a number of other bone samples from these two cases have been analyzed. The concentration ratios for these samples are given in the following table, along with the values presented in the 1978-79 report. The conclusion drawn in that report, to wit, that there is no significant difference in the distribution of plutonium in the bones of the two skeletons, appears to be correct. Over a wide concentration range, the difference in the concentration ratios for any bone is less than a factor of 2.

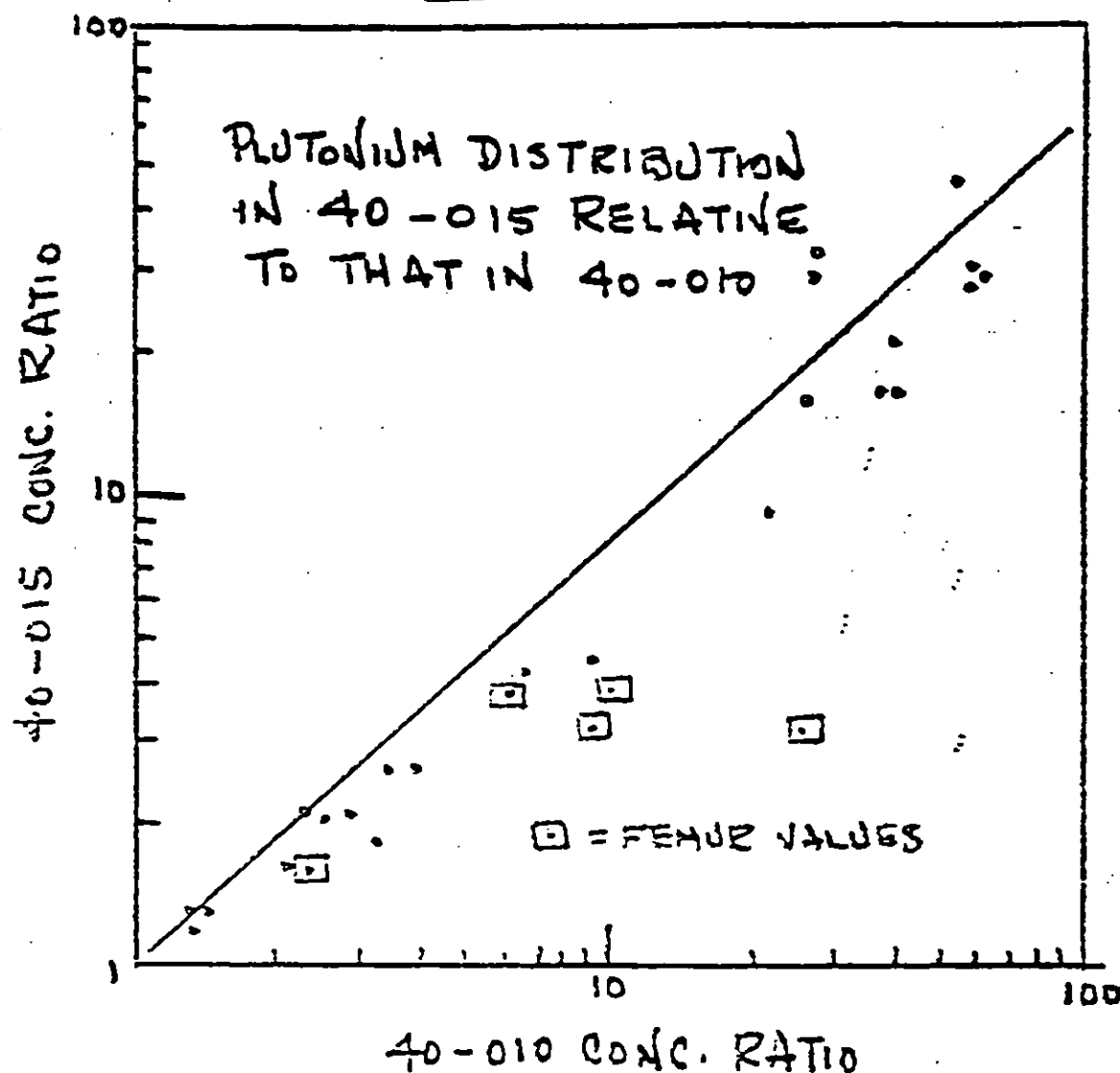
A plot of the values for 40-010 against those for 40-015 indicated that there was a linear correlation between the concentrations in the two skeletons if the values for the femur were not considered. Since there was other evidence that plutonium deposition in the femur in 40-010 was atypical in comparison with that in the rest of the skeleton (the concentrations in the femur heads differed by a factor of about 3 and in the femur trochanters by a factor of about 2), the concentrations in each set were renormalized to the concentration in the respective tibia midshaft and these values were plotted. This plot is shown below.

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It appears that there is a good correlation between the distributions in the two cases when the concentration ratio is less than about 20, i.e., when most of the plutonium is in cortical bone. Beyond this, when there is a progressively higher percentage of the plutonium in trabecular bone, there is more scatter in the data. The only explanation I can offer is that as a result of the osteoporosis in 40-010, there were larger losses of calcium and/or plutonium from the trabeculae of certain bones than there were from others. Considering the facts that (1) they were

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both in very poor health, (2) one was a female and the other a male, (3) and she was about 20 years old and he about 60, it seems surprising that the distributions are so similar. In fact the concentration in a particular bone of 40-015 can be estimated with a relative error of about 25% from the concentration in the same bone of 40-010 using the following equation:

$$R_{15} = 0.6R_{10} + 0.4$$

where R_{15} is the concentration ratio in 40-015

and R_{10} is that in 40-010.

During the coming month or two, a few other bone samples from 40-015 will be analyzed. With the exception of the skull, the remainder are being returned to J. Farnham for reinterment.

RPL/md
Enclosure

cc: R. A. Schlenker
J. E. Farnham
R. D. Oldham
CHR Records Room

Bone	Relative Concentration Bone/Femur Midshaft ^a		
	(1979)	Case 40-010	Case 40-015 40-010/40-015
Humerus shaft		0.97 (2.2)	1.11 (1.6)
Femur head		10.6, 3.86 (25,8.9) ^b	2.11 (3.1)
Rib-2 (B-3)		10.1 (23)	10.2 (15.0) ^c
Rib-8 (D-1)		11.0 (25)	8.95 (13.5) ^c
Sternum		25.7 (57)	18.0 (27)
Vertebrae, cervical, body		25.8 (57)	19.3 (29)
Vertebrae, thoracic, body		23.3 (52)	29.8 (45)
Tarsals		1.41 (3.2)	1.23 (1.8)
(1981)			
Scapula		9.31 (21)	5.86 (8.9)
Manubrium & sternum		25.7 (59)	18.6 (28)
Rib-1 (B-1)		10.7 (25)	10.0 (15)
Rib-9 (D-3)		11.7 (27)	21.2 (3.1)
Rib-10 (D-5)		11.5 (26)	17.3 (27)
Thoracic vertebrae, processes		16.0 (37)	10.5 (16)
Iliac crest of innominate		17.2 (39)	10.6 (16)
Sacrum		16.8 (39)	13.1 (20)
Femur, trochanter		4.44, 2.65 (10,6.1) ^b	2.49 (38)
Femur, condyles		1.25 (2.8)	1.41 (2.1)
Tibia, proximal condyles		1.72 (3.9)	1.76 (2.6)
Tibia, shaft		0.43 (1.0)	0.65 (1.0)
Tibia, distal condyles		0.98 (2.3)	1.41 (2.1)
Fibula, ends		1.48 (3.4)	1.73 (2.6)
Fibula, shaft		0.59 (1.4)	0.91 (13)
Humerus, head		3.91 (9.0)	2.92 (4.3)
Humerus, proximal epiphysis		2.85 (6.4)	2.82 (4.2)
Ulna, ends		1.09 (2.5)	1.45 (2.1)
Ulna, shaft		0.57 (1.3)	0.79 (1.2)
Radius, shaft		0.59 (1.3)	0.85 (1.5)

^a Numbers in parentheses are relative to tibia midshaft

^b Left and right femur, respectively

^c These values are known to be a factor of 1.5 to 2.0 low, as they are for a section of rib

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